

23 April 1969

The following is a list of technical goals for our FY-71 budget:

1. Automatic Target Recognition

The goal for Automatic Target Recognition in general is to automate, or more likely semi-automate, those functions which are tedious, repetitive, and time-consuming, where the photo interpreter functions inefficiently and could be assisted by machines. The goal for this specific budgetary item for FY-71 is to further develop a cloud screener, which is a device to provide a 'yes or no' decision as to whether a target is cloud-covered or not. It would drive to pre-computed target locations on the film and then determine whether or not those specific targets are cloud covered. This device would be capable of scanning film at rates up to 100 ft. per minute. The device would be useable with either negative or positive film and the clue extraction processor could be weighted (biased) toward answering certain specific questions, such as weighting the clues for reprogramming instructions or for determining the degree of interpretability of the target.

2. P.I. Correlated Stereogram Maker

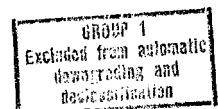
This device will acquire conjugate images from two separate frames, bring them to a common scale and a common rotation, remove any differences in X and Y translation, remove anamorphic distortion (i.e., differential X and Y), and then print these two corrected images on a common film format so that they could be subsequently viewed with relatively simple and inexpensive stereoscopes. Technical goals would be to produce a highly automated system which could find the conjugate images automatically, bring them to the printing head, and then print them with an absolute minimum loss in information content. It is intended that this be accomplished quickly and efficiently enough so that one unit could supply stereograms for up to 50 or 60 photointerpreters. The greatest technical difficulty is in maintaining maximum modulation transfer function due to the large volumes of glass in the optical system of the printer.

3. Ultra Violet Rear Projection Viewer

The technical goal is to develop a rear projection viewer utilizing an ultraviolet projection light source and a fluorescent screen. This viewer would be capable of presenting more than 200 lines per millimeter resolution at the screen with little, or no, loss in image contrast. The screen would be capable of being viewed by more than one person from reasonable angles, off-axis, without appreciable loss in either contrast or light intensity.

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4. Imagery Interpretation Research

This program is much too broad to lend itself well to establishing specific technical goals. The human interpreter and photogrammetrist are fundamental to the Center's entire operations. A thorough understanding of the photo interpretation and of the photogrammetric processes is absolutely essential in establishing a sound technological base for all of our future research and development efforts.

5. Dry Silver and Non-Silver Processors

The technological goal here is to obtain photographic reproduction materials which are either dry-silver or dry non-silver, with resolution and gray scale (density) characteristics which are either equal to, or superior to, conventional, chemically processed silver halide films. These materials must be dry processed, use less silver, or no silver at all, and be economically practical. The ultimate goal is to eventually replace the majority of our chemical facilities currently required to process silver halide films. Long shelf life and archival quality are also prime requirements. Our ultimate goal is to produce a reversal material, e.g., a positive is produced from a positive and a negative from a negative--thereby eliminating one generation of reproduction materials.

6. Chip Storage and Retrieval

Studies conducted under FY-69 and FY-70 funding will establish the future technological goals for this particular program. The FY-71 funding is included for the development of techniques and equipment based upon the results of those studies.

7. Automatic Transport Materials

Once again, this funding is for equipment; the technical goals will be established under studies not yet conducted but planned for FY-70.

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9. Imagery Analysis

The Imagery Analysis program is a fundamental building block of technical understanding upon which other R&D projects related to viewing, mensuration and reproduction are based. A total understanding of the photographic image is essential to extracting the maximum intelligence from the collected image record. The only area which is currently specific enough to list technical goals for is the area of digital image restoration and manipulation. Here the main criteria is the development of a system consisting of: (1) an input device, (2) computer programs, and (3) an output device which permits us to input a photographic record into the computer for manipulation and then subsequently print it out in a permanent high quality record form. The main goal is to provide equipment that is of such high performance characteristics that the process of digitizing the photograph does not impose resolution or contrast restrictions on the final product, which would obviously tend to obviate the benefits of the computer manipulation.

10. Mensuration Equipment

The general technical objectives of this program are to improve current operational and developmental mensuration equipment. The specific areas that we would be attempting to improve upon are: (1) greater automation-- automatic equipment to help determine the density centroid of image edges, (2) better optics through applying the technology learned under our current developmental program for the fabrication of a Wide-Field High-Power Anamorphic Stereoviewer, (3) increased state-of-the-art in laser metrology, and (4) further refinements to the mechanical coordinate motions.

11. Precise Measurement Study

This is a very fundamental search to determine the weakest links in the total mensuration process so that we can develop future equipment which is no more accurate than is absolutely necessary to do the job. This is important since accuracy in mensuration equipment goes hand in hand with major increases in equipment cost. Our technical goals are to obtain the required answers to these fundamental questions. As such, this item does not lend itself well to a listing of specifications.

12. Photo Image Manipulation Viewer Study

This is a study designed to provide information to establish equipment specifications. The long-range goal is to develop a viewer which will allow us to: (1) observe an image, (2) readily change image contrast, (3) vary its gray scale, (4) sharpen image edges, and (5) otherwise manipulate the imagery in order to extract additional information content. A technical breakthrough will be required either in higher resolution, and better gray scale electronics, or in providing some new state-of-the-art optical approach.

- 3 -

SECRET

Approved For Release 2003/03/28 : CIA-RDP78B05171A000200030011-3

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13. Automatic Dodging Equipment

The technical goal is to provide some of the advantages of LOGetronic type printers--in common use on mapping photography--in automatic dodging equipment capable of handling ultra-high resolution reconnaissance imagery.

14. Test & Evaluation Equipment

The goal is to develop those test techniques and test equipment necessary to thoroughly check out future items of research and development equipment programmed to come into the Center for Test and Evaluation. This includes: (a) obtaining better measurements of optical performance than are currently available; (b) developing special techniques and equipment for proving that our ultra-high quality developmental measuring equipments are performing to standards; and (c) the establishing of new standards in areas where none exists, e.g., special standards for dry silver materials which are heat processed and have some totally different characteristics than conventional silver halide materials.

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STANDARD PI INSTRUMENTS/TECHNIQUES

UV Rear Projection Screen/Viewer -- A two phase project for the design and fabrication of a breadboard UV Rear Projection Viewer. Phase I will consist of sufficient preliminary investigations and minimal mock-up to demonstrate the feasibility of the concept. Phase II will consist of mechanical design, fabrication, final testing, and evaluation of a complete viewer.

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FY-70 Funds

Automatic Stereo Scanner Systems -- The fabrication of an automated stereo scanning equipment designed to provide automatic registration of conjugate image areas, automatic removal of image distortions in static or dynamic viewing of a stereo model, and presentation of the stereo view to the P.I. without loss of important information contained in the images.

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FY-70 Funds

PI Correlated Stereogram Maker -- The first stage of design and fabrication of highly sophisticated equipment, for use in the PI work areas, which will print fully rectified, correlated and properly aligned stereograms.

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FY-70 Funds

PI Viewer Printer -- A rear screen viewer capable of enlarging imagery to 2, 4, 7, 10, and 20X on a 20 by 20 inch screen. The exact image portrayed on the screen can be transferred to a 20 by 20 inch print using a diffusion transfer, positive to positive, processing technique.

25X1

FY-70 Funds

UNIQUE CAPITAL EQUIPMENT

High Precision Stereo Comparator -- The fabrication of this instrument is underway and it is due to be delivered early in 1970. It has a two stage, four axis, laser interferometer measuring system with 0.5 micron accuracy, a high-resolution optical system with 10X to 200X magnification, 10 to 1 independent zoom in each leg of the optical system, and 2:1 to 1:1 anamorphic correction, stereo correlation and automatic stage tracking.

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FY-70 Funds

Precise Measurement Study -- A study to review and isolate the major error factors involved in the mensuration process. It will help to identify the error sources, provide a true picture of the current capabilities, and make a knowledgeable projection of further mensuration requirements.

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FY-70 Funds ☐

Simulated Imagery -- The end product will be a computer program (or programs) and computer-generated graphics of the stereo pitched panoramic formats and of stereo strip and oblique strip formats. The simulated imagery will be used to test and evaluate advanced imagery exploitation systems.

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FY-70 Funds ☐

Laser Illumination -- A study to investigate the feasibility of utilizing advanced state-of-the-art scanning laser display systems utilizing a greatly reduced spot size, to overcome the inherent resolution limitations of cathode ray type display systems.

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FY-70 Funds ☐

PI SUPPORT SYSTEMS/DATA BASE

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Collateral Support System -- The ☐ Rapid Search Machine is a free-standing, free text device which can perform searches of digital data in machine readable form at an order of magnitude faster than computer searching is normally done, allowing a whole narrative file to be searched end-to-end with the results immediately available.

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FY-70 Funds ☐

IMAGE ANALYSIS/MANIPULATION/TRANSMISSION

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Image Analysis -- A continuation of a program to provide more fundamental knowledge on the nature of imagery and the interplay between the material, its presentation and the interpreter, so that the exploitation process can keep pace with advancements in acquisition systems.

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FY-70 Funds

Photo Image Manipulation Viewer -- Design and fabrication of a viewer which will permit the PI to manipulate the imagery in terms of scale, contrast, deometric distortions, changes in polarity and edge enhancement for better discernibility and subsequent interpretation.

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FY-70 Funds

PI PROCESS RESEARCH

Exploitation Systems Integration -- An operational analysis support study to perform an objective analysis of the operational aspects of NPIC, with respect to the R&D program, to insure that the most critical problem areas are being addressed.

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FY-70 Funds

REPRODUCTION MATERIALS/EQUIPMENT

Non-Silver Printer Processor -- This is a planned program for the development of techniques & equipment for the printing and processing of non-silver (heat processed diazo) photographic material currently under development.

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FY-70 Funds

CHIP SYSTEM DEVELOPMENT

Automatic Chip Storage & Retrieval -- Based upon the above study, the analysis should result in determination of the type of storage and retrieval (S&R) system required in NPIC. This program is for procurement, installation and check-out of S&R equipment.

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FY-70 Funds

1. Investigate Computer Learning Techniques

An investigation into using computer techniques to lead a novice PI through the correct deductive reasoning involved in coming to proper imagery interpretation conclusions. The computer would lead, guide, and redirect the individual through a series of input and output questions and answers.

2. New Stereo Comparator (IEG)

A new stereo comparator requested by IEG. This comparator would have twin 10" X 10" stages, very high reliability -- with minimum down time and would be between the High Precision Stereo Comparator and the Twin Stage On-Line PI Comparator in both accuracy and complexity.

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3. Develop Advanced Equipment for Digitizing an Image

Considerable work has been done in manipulating images in digital form with advanced high speed computers. Most of these systems are both input and output limited. This item is directed towards the development of a superior, faster, high resolution input device, e.g. laser scanners, diode arrays, etc.

4. Study Color Impact on Viewing & Measuring Equipments

A study to determine the impact upon viewing and measuring equipment designed for exploiting volumetric acquisitions of color film. Of primary concern are the spectral content of the light, color correction of the lenses, the refractive indexes of liquid-gates, and the mensuration impact of working on multiple layer films.

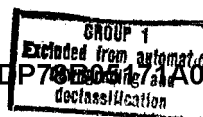
5. Develop Advanced Equipment for Producing an Image after Digitizing

The development of better equipment for reproducing an image resulting from computer manipulation processes. This is the output device referred to under Item 3. It, with the input device and computer, makes a complete digital image processing system.

6. Real-Time Spatial Filtering

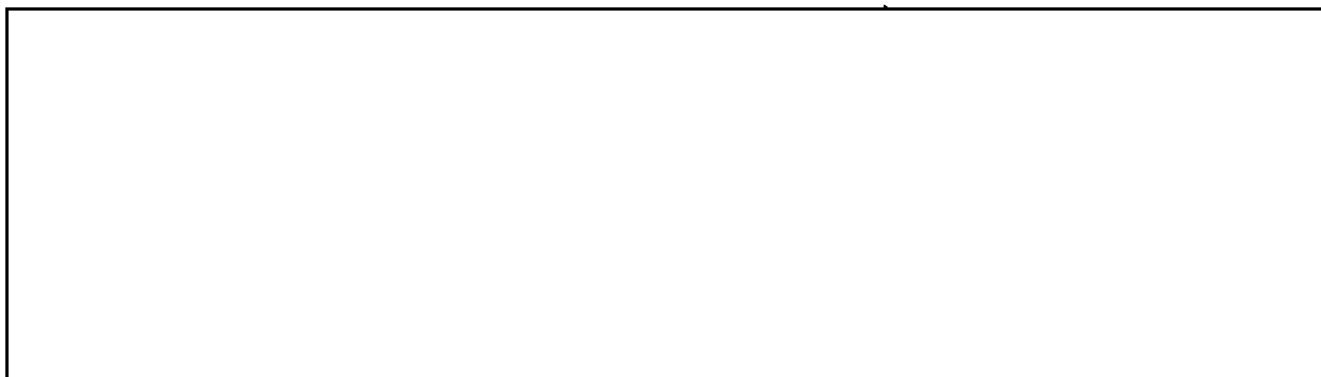
New advances in photochromics indicate that exploratory development in this area may result in the development of a real-time spatial filter; where, the optical filter can be generated on the face of the photochromic by means of a laser or electron beam preprogrammed and driven by computer memory and subsequently erased for production of the next successive filter -- all at extremely high speeds.

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8. Study of PI Motivation

Research into techniques for maintaining high levels of motivation among our PI personnel. Research to determine the factors that increase and decrease motivation and the development of training and management techniques in order to maximize motivation, thereby increasing the overall efficiency of the imagery interpretation process.

9. Automation of Publication Typing Problem

A detailed review of the current typing problem relating to final publication of reports in order to isolate specific areas where automation or semi-automation could result in an efficient long term solution to the problem.

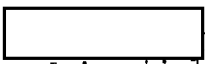
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11. Expansion of Scripps to Cover Dual Gamma

Our current three-month program is taking a cursory look into the total dual-gamma problem. Results may indicate that an extensive effort is needed in this area. If so, utilization of any extensive funding from the main program would result in getting it off track and behind schedule. It appears reasonable that this should be pursued as a branching or parallel effort.

12. Geographic Coordinate Display

 provide us with superior, more timely ephemeral information and inertial geographic positional data. As a consequence, visual graphic or cathode ray tube displays can provide geographic positions and may be orientated to a real time map display keyed to corresponding locations on the film format in a dynamic mode at the PI station.

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13. Applications of Baysian Theory to PI Process

Reconsideration of the possibility of applying Baysian type mathematics to the PI process with the intent of determining the minimum scrutiny required to assure the desired probability of detecting and identifying critical targets. [] is now involved in a Baysian process study directed at a totally different requirement.

14. Applications of Wide Field Designs to Zoom 240 or Similar Instrument

As the result of our investigations directed toward the Wide Field High-Power Anamorphic Stereo Viewer, [] has developed some new computerized design techniques and optical technology which is advancing the state-of-the-art in high quality, wide field optics. It appears reasonable that we should investigate the application of this technology toward perfecting a superior version of an instrument such as a Zoom 240 -- maintaining high performance while at the same time materially expanding the field of view.

15. New Techniques for Checking Accuracy of Laser Interferometers

The High Precision Stereo Comparator and the chip comparators both use laser interferometers as their measuring system. It is predicted that other highly accurate interferometric systems will be developed in the future. Since the laser interferometer uses the wave length of light as its standard of measurement, it is extremely difficult to check the accuracy of these instruments and prove that these instruments are, in fact, performing to specifications. Techniques need to be developed to provide means for testing interferometer performance -- thereby determining the measuring accuracy of our most precise instruments.

16. Parallel Optic of Electronic (ATR) Effort []

As the result of our current [] effort, we are faced with making a decision whether to implement the optic or electronic method of clue extraction. Each system has its own unique advantages and disadvantages and while one will prove best for this particular application, it would seem wasteful to abandon research on the other technique entirely, since, it may be more efficient for other projected applications. This project would be a parallel effort in that technique not chosen for implementation of the current program.

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